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THE NATIONAL CATENOID SPEAKER SYSTEM

Part I - General Description and Subjective Appraisal

The Catenoid is a three-way corner speaker system incorporating a front-loaded horn for the bass, a cone speaker for the middles, and a small horn-loaded tweeter for the highs. It is pleasingly proportioned, 36½" high, extending 28" from the corner along each wall.

The Catenoid was tested early in our speaker test program, and unfortunately not all the tests outlined in our last issue were performed. Only the frequency response, harmonic distortion, and Briggs transient tests were applied to the Catenoid, plus a rather extensive series of listening tests and A-B comparisons with other speaker systems.

Our first listening test was performed out-of-doors, on the occasion of our response and distortion tests. The speaker was placed in a concrete corner extending for several feet beyond it. Regrettably, one wall was only as high as the speaker system. Hardly an ideal arrangement for testing a corner horn, but certainly better than an open field or the inside of a room.

High quality recorded music was fed to the speaker via a Williamson amplifier. The moment we heard it, each member of our staff felt that this speaker system was "right". It had a definite sense of ease and a beautifully balanced overall sound. Later, indoors and under more usual listening conditions, we were even more impressed.

In our second issue (November, 1954) we commented on the L.E.E. Catenoid, noting its Klipsch-like sound. For some years the Klipsch K-type horns and several similar systems built by other manufacturers under license from Klipsch have been widely considered to be among the finest speaker systems available. Any speaker which even suggested their standard of performance, yet cost less than half as much was obviously worth investigating.

Therefore, one of the first A-B comparisons we made was with a Klipsch-type system whose performance we knew to be above reproach. Program material was obtained largely from a tape recording of a group of vocal, organ and harp selections, recorded from live performance with an E-V 655 microphone and an Ampex 400 recorder at 15"/second tape speed. Playback was through the same recorder, Brociner CA-2 control amplifier, and 3 Williamson amplifiers (two for the Klipsch system, one for the Catenoid).

We felt that the quality of program material being supplied to our speakers was well beyond the capabilities of any speaker system to reproduce with anything like complete fidelity. Included were 32-cycle pedal organ notes, solo voices and choirs, and the exceptionally transient sounds of the harp.

The program material was frequently switched from one speaker system to the other without any off time. A group of audiophiles and lay listeners composed our test panel. Each listener at times preferred one speaker and other times preferred the other. Most of the time no preference was expressed. When one particular speaker was preferred, the reasons were not usually consistent. That is, at one moment the Klipsch would seem to have better bass, and a minute later it would seem not as good as the Catenoid at the bass end.

More consistent opinions were evidenced on middle and high frequency reproduction. The Klipsch system was equipped with a Western Electric squawker (400-cycle crossover) and a Jensen RP-302 super-tweeter (5000-cycle crossover). As normally adjusted (each speaker having its own level control) this system seemed to have more "snap and sparkle" to its high end. The Catenoid (no level adjustments provided) almost always sounded mild and unobtrusive by comparison. Some individuals feel that brilliant highs are essential to high fidelity reproduction; others are irritated by them.

In spite of individual preferences, all our listening panel members agreed that the Catenoid and Klipsch systems were definitely in the same class performance-wise. They do not actually sound alike at all, but the differences are of such a nature that we feel it probable that most audiophiles would find it difficult to make a choice between them on the basis of an A-B listening test. We suspect the relatively small size and low cost of the Catenoid would prove to be the deciding factors in many such cases.

We will try to verbally describe the sound of a Catenoid for the benefit of those readers who have not had the opportunity to hear one. The outstanding characteristic of this system is balance. It is not bassy, not shrill, not obtrusive in any way. It is uncannily smooth, with absolutely no sense of "divided sound sources" even though the three speakers are well separated physically. The major part of the sound one hears comes from the mid-range speaker (300-6500 cycles). The tweeter carries only the harmonics of the highest musical

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*Please note that we use the expression "Klipsch" or "Klipsch-type" at several points in this report. The bass horn invented by Paul Klipsch has become accepted by many as a standard of excellence in speaker enclosure design, and the term "Klipsch" has, to us, a generic significance, just as "Frigidaire" for many years was synonymous with "electric refrigerator" or "Kodak" with camera. We use "Klipsch" in referring to folded bass corner horns similar to the Klipsch design, whether built by him, his licensees, or home constructed. We did not, however, at any time compare the Catenoid directly with a Klipschorn manufactured by Klipsch and Associates.

CRAFTSMEN C-900 FM TUNER

The high performance claimed for the C-900, plus its modest price ($99.50, direct from the manufacturer*) make it of more than ordinary interest to many audiophiles. When it was introduced a couple of years ago, it was priced at $119.50, and some astronomical sensitivity claims were made. Subsequently, the Radio Craftsmen changed their organization and merchandising set-up rather drastically, selling only direct to the consumer and reducing prices on their entire line. Apparently, the advertising and engineering departments got together and reduced the advertised sensitivity of the C-900 to 2 uv for 30 db of quieting. This is still a phenomenally high claimed sensitivity.

The Audio League initially tested two C-900's, which were manufactured before the reorganization of Craftsmen. We found their sensitivity disappointingly low, but inasmuch as they had been used on home installations for several months, we hesitated to base a report solely on these units.

We corresponded at some length with Craftsmen's Chief Engineer in order to determine how our test methods compared with theirs. Finally, they sent us a C-900, presumably selected from current production and which they indicated had been selected to meet their specifications.

This set was certainly sensitive - so much so that it was loaded with spurious oscillations. These appeared as signals every megacycle or so across the entire FM band. Frequently, one of these signals would fall on top of a desired station, effectively blotting it out. Possibly a little realignment of the set would have cured this trouble, which suggested that the tuner had a bit too much gain. However, it is our policy to test units as received, and we do not attempt to correct any apparent deficiencies.

The reader is referred to Vol. 1, No. 3, page 2, and No. 5, page 7 for a description of our FM tuner Testing Procedure. Figure 1 (right) is the noise quieting characteristic of the C-900 sent us by Craftsmen. It can be seen that its sensitivity falls short of the 2 uv for 30 db quieting claimed by the manufacturer, by a factor of 4. Our measurements are in "hard" microvolts, and we rather suspect the C-900's performance is rated in the "soft" variety, as are most advertised tuner sensitivities. This reduces the discrepancy between claims and measurements to a factor of two, which can easily be accounted for by variations in tube characteristics, alignment, and measuring techniques.

Our conclusion on the sensitivity of the C-900 is that it is reasonably high, certainly adequate for the vast majority of users. Nevertheless, a person buying this set for extreme fringe area reception and expecting 2 uv sensitivity would probably be deluding himself. Remember that this tuner, selected by the manufacturer, only showed a sensitivity of 1/2 to 1/4 the advertised value, and obtained this at the cost of stability. In view of the wide variations in performance among the three C-900's we tested, we suspect that the manufacturer's quality control department was not up to par. We understand that this condition has since been corrected, but have not tested any Craftsmen products since the C-900. Fortunately, sensitivity is only one quality of an FM tuner, and generally not the most important one, at that.

The C-900 features variable amplified AFC, with a front panel control for continuous adjustment of AFC action. We don't understand the need for amplification in an AFC loop, since any run-of-the-mill AFC system we've ever seen had more than enough "pull-in". In fact, recent trends have been toward reduction of AFC action to permit tuning in weak stations close in frequency to strong ones. The C-900 offers a range of AFC action from zero to considerably more than anyone is likely to want. The flywheel tuning is exceptionally smooth and positive.

One unique C-900 feature is the 20.6 megacycle printed circuit IF transformers. One would expect great stability from this sort of design, and Craftsmen claims that tube changes will not require re-alignment of the IF stages. Ordinary IF stages, as found in most FM sets, may have their tuning affected markedly by tube changes.

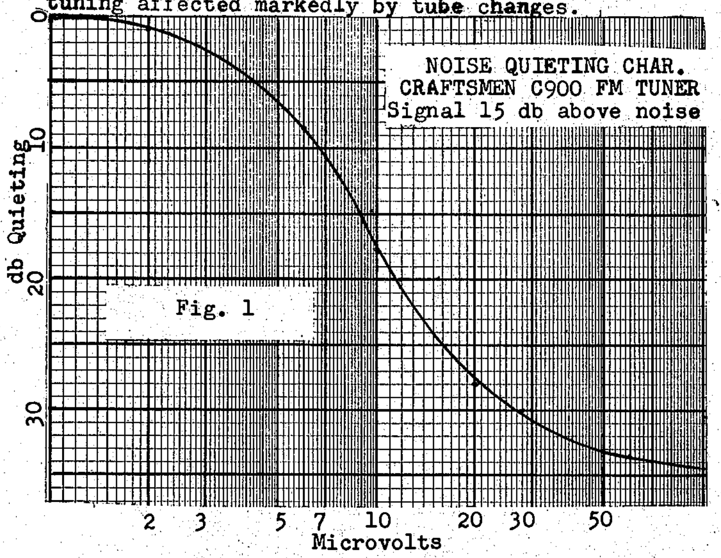

Fig. 1

A 20.6 mc IF system should have excellent bandwidth, as required for distortion-free FM reception. Obtaining steep-skirted IF response, for rejection of strong adjacent or alternate channel signals, should be rather difficult. Our measurements showed the IF bandwidth of the 3 db Points measured at the limiter grid, to be 250 kc. This is certainly adequate. Home listening tests showed that the audio quality of the C-900 is above reproach. No difference could be heard between it and any of a number of other good tuners. Rejection of adjacent channel interference was adequate, though not outstanding. With AFC disabled, variation of line voltage from 105-135 volts caused a large drift, sufficient to lose a station completely. A moderate amount of AFC corrected this entirely.

The tube lineup of the C-900 is fairly conventional, though on the "hot" side. A cascode RF stage is used, with 3 IF's and two limiters.

Construction is substantial, with no evidence of skimping or sleazy details. It runs rather cool, which is somewhat uncommon in modern hi-fi gear. After 8 hours continuous operation, no part of the chassis or power transformer was uncomfortable to the touch. We've seen many other sets which could not be touched for more than a second or two after a few hours operation. The C-900 sports the usual Craftsmen chrome plated chassis, and is generally an attractive, somewhat conservative-looking receiver.

Summary

The C-900 must be appraised with due regard to its price, its competition, and the unusual merchandising policy of its manufacturer, as well as on its absolute performance.

At the time our tests were performed, several months ago, there were few quality FM tuners in the $100. price class. In our opinion, the

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*The Radio Craftsmen, Inc., 4403 N. Ravenwood Ave.,
Chicago 40, Illinois

* Since writing this, we hear that Craftsmen is again selling through dealers only, at the former prices.

National Catenoid, continued from page 1

notes. It is actually extremely difficult to locate it by listening with one's ear pressed to the grill cloth. The woofer provides a wide source for the frequencies below 300 cycles (very similar to the Klipsch sound) yet carries mostly the fundamentals of the lowest musical notes. These low frequencies are not significantly directional and their propagation from the mouth of a large horn does much to establish the characteristic sound of the Catenoid. The Klipschorn, for example, propogates its middle and high frequencies from a large exponential horn, giving the entire spectrum a large, fully dispersed sound. The Catenoid middles come from a cone speaker and probably do not in themselves have the "broad" sound characteristic of a Klipsch, yet the fact that the lows do have this characteristic somehow seems to impart the same property to the higher frequencies.

Many two-way systems possess the characteristic of "divided sound", usually considered undesirable. The high frequencies appear to come from a different location than the low frequencies, which they do, in fact. At a distance, the two merge into a single apparent source, but in a small room there is no way to avoid the difficulty. In the Catenoid, the absence of "divided sound" is noteworthy.

As we have said, virtually all the audible sound from the Catenoid emanates from the 8" mid-range speaker, with the other two filling in the "body" and "edge" of the sound. Even 2 feet from the speaker there is no sense of division - a real advantage in a small room.

The Catenoid speaker system was developed by the Laboratory of Electronic Engineering, Inc. (L.E.E.) of Washington, D. C. a couple of years ago. For a year or so it was marketed by L.E.E., but last year it was taken over by the National Company and added to their line of hi-fi components. It is available in several wood finishes, as well as formica-impregnated wood. Our test unit, loaned to us by National, was finished in blonde Prima Vera formica, and presented a strikingly beautiful appearance which invariably aroused favorable comments. It is priced at $295.

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Craftsmen FM Tuner, continued from page 2

C-900 is a well-constructed receiver of good performance. It ranks high among competitively priced tuners of that time. There are now appearing several new tuners in that price bracket that may change the picture somewhat. Until we have tested them, we won't know.

The variations in sensitivity among the three tuners we tested make it difficult to recommend the C-900 for extreme fringe area reception. The third set (if it didn't have the spurious oscillations) would have been quite satisfactory in many such applications, and at its price, would have been a good value. The first two, while OK for reception up to 30 or 40 miles from the station, would have proven disappointing at a 75-mile or greater distance.

A serious consideration is the fact that the C-900 cannot be purchased from dealers. With other makes, if trouble develops, the set can be returned to the store where it was purchased and an adjustment obtained. With Craftsmen products, they must be returned to the factory in Chicago, which entails shipping expense and loss of use of the equipment.

A buyer willing to take the risks just mentioned has a good chance of getting a better than average tuner at a relatively low price. The listening quality of the C-900 - and after all, that is what the buyer is looking for - is about as good as any tuner we know of, regardless of price.

Part II - Technical Report

The Catenoid is named after the mathematical curve of its horn expansion. It has a much slower rate of flare than the usual exponential horn. In fact, it is almost a conical horn, folded into a compact shape. The statement has been made in literature describing the Catenoid that this flare possesses advantages over the more common exponential tapers but no further information has appeared on this subject. We cannot pass on the validity of this theory, but hope some of our mathematically-minded subscribers will work on this problem and send in their conclusions.

There is little doubt that the Catenoid curve makes possible a relatively simple internal construction. The "innards" of the Catenoid are considerably less complex than those of the Klipsch "K" horns, which accounts in some measure for its low price. Construction is of 3/4" plywood throughout, and it is extremely rigid. A sharp rap with the knuckles on any part of the Catenoid produces a "click" rather than a "thump" or "bong".

Shortly after hearing the Catenoid for the first time, we were overcome by curiousity as to what manner of speaker was producing that solid bass. We opened up the panel through which the speaker is mounted, and were quite surprised to find a University 6200! This is a 12" general purpose speaker in the $20. price class. The caliber of sound produced by this system is a tribute to this rather unglamorous speaker and to the effectiveness of the bass horn design.

The mid-range speaker and tweeter are contained in a tightly sealed compartment at the top of the enclosure. The 8" mid-range unit was unmarked, but we feel it is responsible in no small way for the overall performance of the system. It is a smooth, clean-sounding job. The tweeter was found to be the ubiquitous University 4401. This inexpensive compression-type tweeter has a justly deserved reputation for excellence. Even the $700. Klipschorn uses it!

The crossover network is located inside the enclosure, with no provision for any external adjustment of the relative levels of the 3 speakers. It is apparent from listening that the balance between them has been carefully designed into the system. However, there may be individuals who would prefer to try their own adjustments.

Fig. 2 shows the frequency response and harmonic distortion curves taken on the Catenoid system in its outdoor corner. These are included as a matter of general interest, but should not be interpreted as showing the true performance of this system in the home. What these curves show is that without the room walls to extend the horn expansion, the Catenoid cuts off sharply below 50 cycles. Listening tests in a living room showed that response was excellent down to 40 cycles, and a fair amount of fundamental was generated at 20 cycles. This is confirmed in Fig. 2, where even under most unfavorable conditions, the harmonic distortion at 20 cycles was only 80%.

Although relative efficiency measurements were not made on the Catenoid, we judged from listening comparisons that its efficiency was comparable to that of the Altec 604/Karlson 15 system. It is definitely not as efficient as a Klipschorn, which is not surprising when one considers the low cost speakers used in the Catenoid.

The most startling measurement we made on the Catenoid was the Briggs transient test. In this, a battery is connected to the speaker through a small resistance, of approximately 10 ohms, and then removed, leaving the speaker shunted by a resistance of the order of thousands of ohms. The electrical transient waveforms across the voice coil are observed at the time of making and breaking the battery connection by means of an oscilloscope. An oscilloscope camera records both waveforms on a single picture.

Most speakers have at least one major (low frequency) resonance. In this test, one would expect them to show a "ringing" of one or more cycles at this resonant frequency, when the battery is connected or disconnected. On the "make", the speaker is shunted by a low resistance and fairly well damped, so the oscillation should be brief and of low amplitude. On the "break", a relatively poorly damped speaker will show a large amplitude of oscillation lasting for many cycles. The better the damping of the system, the less prominent this ringing will be. The interpretation of these waveforms is rather compex and frankly, we haven't been able to correlate the results of this test on other speaker systems with their sound qualities, except in the general sense that the lowest resonant frequency, smallest amplitude, and shortest duration of ringing are most desirable and most likely to be found in the better speaker systems.

A perfect transducer, non-resonant and matched to its acoustic load, would show no ringing at all - merely a voltage pulse decaying exponentially at both make and break, with different time constants due to the different resistances in the circuit. One would not expect to find such a characteristic associated with any physically realizeable speaker system. Therefore, imagine our surprise when the National Catenoid did just that!

When we first observed this phenomenon, we thought the speaker had become disconnected. However, a click could be heard at the make and break switching. Side-by-side comparisons with several other systems showed that the Catenoid's damping was better than any other by one or more orders of magnitude. Our Dumont 304A scope did not have enough gain to show the slightest trace of overshoot or ringing, on either make or break. A slight difference in the exponential decay rate was detectable as would be expected.

On other speaker systems, including our standard reference system, the ringing was clearly visible on the scope, with a gain factor of 10 to 100 to spare.

It would be easy, using the faulty logic sometimes found in this business, to conclude that, because the Catenoid shows one of the characteristics of a perfect transducer, it must therefore be a perfect transducer. This, of course, is ridiculous. The conclusion we drew from this test data is that the Catenoid is a phenomenally well-damped system - so much so that our measuring techniques are not adequate to determine its true performance in this respect.

Our measurements show two points on which the Catenoid could be considered somewhat less than perfect. First, its low frequency response falls off below 40 cycles, even indoors. At 30 cycles, it is down far enough so that one could question the advertised lower limit of 30 cycles. Even so, as we mentioned, in A-B listening comparison with a Klipsch system, it easily held its own at the lowest frequencies likely to be encountered in music. Part of this may be accounted for by the fact that reasonable amounts of fundamental can be gotten out of the Catenoid as far down as 20 cycles. It has been our experience with horns of the Klipsch type that their response falls off rather steeply below some frequency between 30 and 40 cycles.

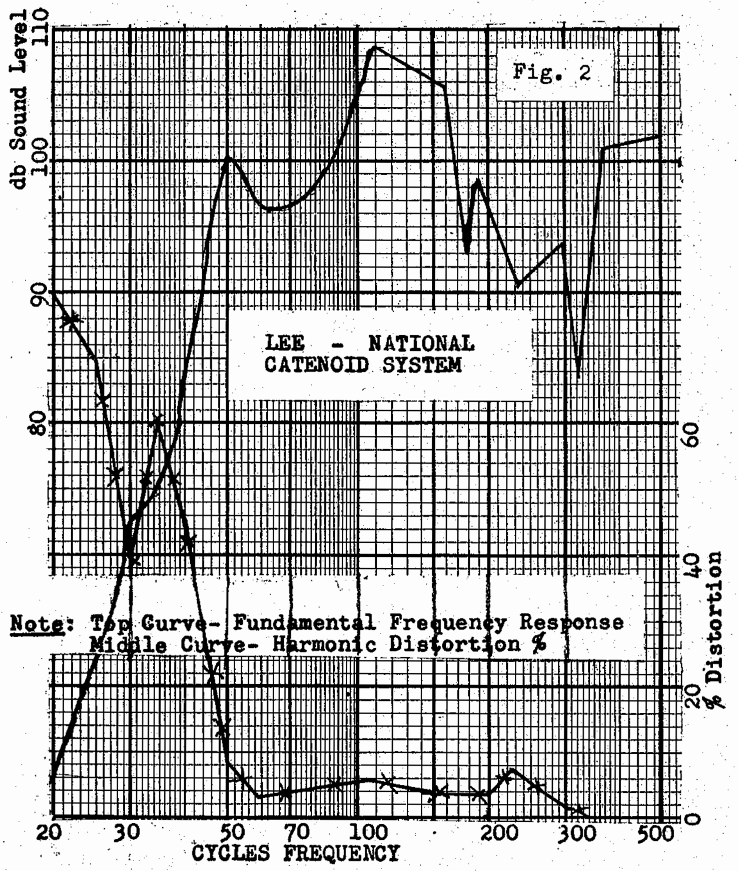

Fig. 2

Note: Top Curve- Fundamental Frequency Response
Middle Curve- Harmonic Distortion %

Fig. 2 shows a hole at 300 cycles which may be a crossover cancellation between the woofer and the mid-range speaker. Unfortunately, we were not able to test the speaker in a number of locations so we cannot tell if this hole is real or a result of our test set-up. It was certainly not audible in listening tests.

The second crossover is at 6500 cycles, with the result that virtually nothing is heard from the tweeter except hiss, pops, and squeaks. Nevertheless, the "edge" and "sparkle" of reproduced music are associated with these frequencies and the tweeter makes an important contribution to the overall balance and naturalism of this speaker system.

The Catenoid is described as the first basic improvement in loudspeaker design in a decade. There might be some argument on that point. Nevertheless, we feel that the designers of this system have achieved practically all their stated goals, which is no mean achievement.

They claim for it:

1) Maximum economy of space utilization. True. Not a cubic inch is wasted. A lot of horn has been squeezed into a relatively small space. Structure is greatly simplified over other folded horns which do not employ the Catenoid taper (i.e., Klipsch).
2) Dignified, graceful appearance and pleasing proportions. We agree. In our opinion, this is one of the most attractive pieces of hi-fi furniture on the market.
3) The finest of all home speaker systems, the ultimate speaker. No, but certainly one of the finest.

4) The horn inherently swamps out the usual resonances encountered in speakers. Our transient tests would certainly seem to confirm this claim.

5) Exceedingly smooth frequency response from 30-17000 cycles. Not quite that good at the bass end, and we could not measure the high frequency response. Otherwise, our listening tests indicate this to be a system of outstanding smoothness and cleanness of response.

Summary

The National Catenoid is one of the finer speaker systems on the market. There are others which are better on the low end, and some which are better at the high end. In our opinion, however, few, if any, speaker systems can match the Catenoid's combination of superlative balance, smoothness, reasonable size, clean styling and moderate price. In A-B comparisons, it easily holds its own against systems costing twice as much and occupying nearly twice its volume.

Although this had no bearing on our performance ratings, we are impressed with the fact that a high order of performance has been obtained through efficient utilization of three low-priced speaker units. This contributes in no small measure to the moderate price of the Catenoid system.

If we were to sum up our impression of the Catenoid in one sentence, it would be this. It is very easy to listen to for extended periods without the speaker intruding with any special effects.

AES CONVENTION

At the Audio Engineering Society convention recently held in New York City, one of the technical sessions was dedicated to the consumer's viewpoint on high fidelity. Representatives of Consumers Union, Consumers Research, and The Audio League presented papers dealing with various aspects of this subject.

The viewpoint of The Audio League is best expressed in the closing paragraphs of the paper presented by Julian D. Hirsch, Editor of The Audio League Report. We reprint this here.

"The duties and desirable functions of a consumer hi-fi evaluation service may be summarized as follows:

"1) It should test products and report on how closely they conform to their advertised specifications;

"2) Product ratings should reflect their utility to the consumer. 'Gimmicks' and features which are the outgrowth of fads rather than sound design should be pointed out as such.

"3) Where industry-wide standards exist, they should be followed. Otherwise, tests should attempt to define equipment performance in a typical home environment rather than under artificial laboratory conditions. Measuring techniques should be employed which give reliable, repeatable test data.

"4) The consumer must be provided with sufficient general background (not necessarily of a technical nature) to permit him to make intelligent selections based on manufacturers' claims. He must be made aware of which features are important or desirable and which are designed strictly for sales appeal.

"In all cases, the final goal of a hi-fi system must be kept in mind,—the most natural and pleasing reproduction of music in the home. Regardless of what laboratory measurements or theoretical considerations may indicate, the ultimate criterion for consumer acceptance must be pleasing and natural sound."

EVALUATING CARTRIDGES - THE AUDIO LEAGUE VS. CONSUMERS UNION

Many readers have written us regarding the radically different phono cartridge ratings published by The Audio League and by Consumers Union. Many others have no doubt wondered about this without bothering to write. We wondered ourselves - certainly it is hard to believe that CU and The Audio League were rating the same cartridges. This applies in particular to the top three on our list, which were rated at the middle or near the bottom of CU's list (see Consumer Reports, October 1955, page 453 and The Audio League Report, Vol. 1, #6/7). The ratings of intermediate and lower quality cartridges by both organizations were in good general agreement, with one possible exception.

We understand all too well the difficulties of conducting repeatable and meaningful tests, particularly on such items as pickups and speakers. Therefore, we might expect to find some fairly substantial differences in test results between other testing organizations and ourselves. Surprisingly, this was not the case with CU. We find ourselves in rather close agreement on most points. The major difference was the matter of distortion. CU found plenty of it where we found little.

Where does the discrepancy lie? We believe it is the result of two fundamental "errors" on the part of CU. First and foremost, they base their ratings solely on laboratory tests, with no weight being given to listening tests. We rely heavily on listening comparisons, as well as laboratory measurements, since there is considerable difference of opinion, even among cartridge manufacturers, as to what constitutes a meaningful test of cartridge performance. Our own experience with test records has caused us to question their value as a means of making fine distinctions between cartridges. They do give a pretty good idea of the smoothness and overall response of a cartridge, as a study of our issue 6/7 will show. At the present state of the art, in our opinion, a rating of cartridges in any order of preference must be based largely on A-B listening comparisons.

In connection with this, The Audio League receives information from readers and dealers on their reactions to various products, cartridges included. This, in effect, broadens the base of our listening panel, giving us the benefit of the experiences of a much larger group of people than our own staff. While we naturally do not give the same weight to these reports as to our own tests, they do play a part in our evaluation process.

The second "error" of Consumers Union is somewhat related to the first one. It is a failure to appreciate the significance of some of their own tests. As a result, test data are sometimes misinterpreted, leading to confused evaluations. An example of this type of "error" is on page 453 of their October 1955 issue. Two oscillograms are shown taken from the output of ESL Professional and GE RPX-052A cartridges when playing the 8 kc test band of the Folkways FPX-100 test record. The GE picture shows an easily recognizable sine wave modulated carrier. The ESL picture appears peaked and distorted, conjuring up pictures of unpleasant sound in the mind of a technically trained reader and probably leaving the layman little the wiser.

What is the true meaning of the oscilloscope pictures shown? The test band in question is designed to detect intermodulation distortion (IM). An 8 kc carrier is modulated by a 60 cycle tone. If no IM existed anywhere in the playback system, only an 8 kc tone would be heard. Any IM will show up as an audible 60 cycle hum, whose intensity is proportional to the degree of distortion.

(As we stated in our report on test records, there is an audible hum of the same level from this band with any cartridge we've tested thus far. Either all the cartridges have the same IM distortion or there is more residual IM on the record than is produced by any of these better cartridges. We are inclined to believe the latter, though we could be wrong.)

CU's caption for the ESL photograph states that it shows the high-frequency distortion of the ESL Professional, as compared to the GE. It is implied that the latter has very little high frequency distortion. In one way, only, this would be quite true. However, let us look at the whole picture. The "high frequency distortion" of the ESL is just that - frequency distortion, rather than harmonic distortion. Its high frequency response rises considerably above 10 kc. to a peak of 12 db or more at 23 kc. Any harmonic distortion in the 7-8 kc region (and some distortion is present in any practical system) will be greatly accentuated by the rising response characteristic. The ESL filter, which flattens out the response characteristic, completely eliminates this effect.

The GE has no significant response at 15 kc or above. Therefore, no matter how much distortion is in the pickup or on the record at 7-8 kc, it will not show up in the cartridge output. This is a simple elementary fact. The high frequency distortion of the GE shows up in a steep roll-off of high frequencies above 10 kc instead of a rise as does the ESL.

The CU scope photos show nothing derogatory about the ESL Professional cartridge. They merely show that it has a rising high frequency characteristic, which is well known, and which has absolutely no adverse effect on the sound. Similarly, they do not show any significant information on the GE, since its lack of extreme highs can account for the published picture, regardless of how it may perform at lower frequencies. It is unfortunate that one not familiar with the Folkways test record could receive a false impression of what these photographs mean.

That ESL picture, bad though it looks, does not indicate any significant amount of IM distortion. IM shows up as an asymmetrical pattern, and the published picture is certainly symmetrical. As one might expect, use of the tone controls will shape the response curve so that almost any desired pattern can be produced. When the highs are rolled off, the picture looks like the "GE picture"; when the highs are boosted, it resembles the "ESL picture".

A further statement is made in CU's text on page 454, referring again to the ESL. It is stated that "linearity is very good", and in the same paragraph, it is stated that there is a large amount of distortion and IM in the vicinity of 7 kc. These are contradictory statements. Linear devices do not distort, by definition. This sort of semantic confusion does little to clarify the picture.

The loss of low frequencies noticed by some people, when using the ESL 201 transformer, was due to improper termination of the transformers. When terminated in their rated 200 ohms, they flatten out nicely. The difficulty arose because early units were so good that they gave flat response with almost any termination. Later transformers failed to meet this high standard. Unfortunately, ESL's inspection got a bit lax and failed to catch this in time.

The two other cartridges on which we disagreed rather drastically with CU's rating were the Fairchild 220A and Pickering 240. At first, CU rated the 220A on top of their list, but later data on additional samples showed excessive distortion. The 220A was moved down to a position below the Ronette. The Audio League has tested five Fairchild 220A cartridges from at least 3 different production runs over a period of 6 months. All were of uniformly high quality. However, Fairchild admits that a number of defective 220A cartridges did reach the dealers' shelves, and no doubt CU's samples came from this batch. Most of these were recalled, and Fairchild will replace any of these units without question. Since the quality of the 220A cartridges made before and after this brief episode is admittedly of the best, it seems a bit arbitrary to continue to rate this superb cartridge near the bottom of the list.

We are completely at a loss to understand why the Pickering 240 has received its low score in CU's ratings. It takes a good ear to tell the difference between it and the Fairchild 220A, and many people prefer it to the Fairchild. No significant amount of distortion was found in any of our tests with either cartridge.

For reasons best known to themselves, CU continues to publish a high rating for the Fairchild 215A, which has not been manufactured for over a year. It was a fine cartridge but has now been obsoleted by the even better 220A.

We were scooped on one item - the Recoton 500. This turnover variable reluctance cartridge is priced competitively with the GE RPX-052. It was unfortunately not included in our cartridge survey. CU rated it #1. We have subsequently tested it, and will present our full report in an early issue. The Recoton is unquestionably a "best buy". We would place it just ahead of the Fairchild 215A, though it conceivably could be put in the same category as the Fairchild 220A. Certainly, it is difficult to tell the two apart in A-B listening comparisons

We would like to make it clear that we are not using all this space on behalf of any manufacturer. The issue is: which organization's methods of evaluating hi-fi components is valid? Perhaps neither is - certainly not both! The final judgment must be left to the public.

For the record, we are listing below our evaluation of cartridges, together with CU's rating of the same units. We see no reason to change our ratings in any way.

Audio League	Consumers Union
ESL Professional ESL Concert	Recoton 500 Fairchild 215A
Fairchild 220A Pickering 240	GE RPX 052 GE RPX 052A ESL Professional ESL Concert
Recoton 500 Fairchild 215A	Audak R-2 Pickering D-140-S
Audak R-2 Pickering D-140S ESL - Standard	Ronette TO-284P Fairchild 220A Sonotone 1P Pickering D-240
GE RPX 052/052A	ESL Standard Sonotone 9980-S
Ronette TO-284P Sonotone 1P Sonotone 9980-S	

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- Acoustic Research AR-1/AR-1W
- Bard Ortho-Sonic V-4 Tone Arm
- Jenszen I-30 Electrostatic Tweeter (preliminary)
- Highlights of the 1955 New York Audio Fair.

BRIGGS' CARNEGIE HALL SOUND DEMONSTRATION

On Sunday, October 9th, at Carnegie Hall, Mr. Gilbert A. Briggs (of Wharfedale Loudspeakers in England) gave a creditable demonstration of sound reproduction from tapes and records as compared to the original live music. It was a job that took a great deal of courage since it was not "rigged" to hide the deficiencies of the speaker systems. No American speaker system manufacturer has yet had the courage to make such a demonstration - although we believe several could do at least as well in such a comparison test.

Live performances were given by such celebrities as E. Power Biggs at the organ, Leonid Hambro at the piano, John DeLancie on the Oboe, and the Philadelphia Woodwind Quintet. Records used were made by Audiophile, Mercury, Angel, Columbia, EMI, and London ffrr. Tapes were by Columbia at 15" per second. The electronic equipment included four 15-watt Quad II amplifiers (one for each speaker system), Garrard 301 turntables, Leak and Ferranti magnetic pickups, and four Wharfedale corner reflex enclosures of 9 cu. ft. volume. Two of the enclosures were sand-loaded and two were lined with tile. The reflex boxes each contained a 15" Wharfedale woofer. Mounted on top of each reflex box in a separate enclosure were two 3" tweeters and an 8" mid-range speaker. The tweeter boxes were placed at various angles to give better dispersion of the high frequencies in the large hall. Unfortunately no corners were used for the corner reflex enclosures, and this prevented their maximum bass performance.

The results were astounding to some. If one kept his eyes closed, it was sometimes impossible to tell when the live music ceased and the reproduction began. This was particularly true for the Mozart Wind Quartet selection and for the Oboe and Piano rendition of the Sonata in C Minor by Handel, both recorded on Columbia tape. Even where the live music had more bass, or was richer in tone, or had more highs, a few minutes of listening to the recording completely washed away the differences noticed at the changeover from live to recorded performance and back. The changeover was made as many as twenty times in a single selection. The live organ had considerable more bass power than the recording, even though they were played at an equal loudness level. We understand there were some members of the audience who preferred the recorded organ to the live, although the best ears of the Audio League listening panel were definitely not impressed.

The demonstration also provided an interesting insight into the power required by a reproduction system. An indicator showed the maximum RMS power being delivered to the speakers. One observed that for full natural volume in Carnegie Hall, Handel's Concerto Grosso occasionally hit 8 watts; a very loud passage in a piano solo reached 10 watts; a large choral group with organ required 20 watts; while only massive orchestral sounds and the pipe organ reached 40 watts. The Audio League believes this further reinforces their opinion that 10 to 20 watts of amplifier power in the home would give more than complete satisfaction except for the most inefficient speaker systems.

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CORRESPONDENCE

IF YOU HAVE ANY QUESTIONS REGARDING YOUR SUBSCRIPTION, ISSUES, OR OTHER MATTERS, PLEASE ENCLOSE A SELF-ADDRESSED POST CARD AND YOUR CODE NUMBER. INQUIRIES NOT INCLUDING SUCH A POST CARD POSITIVELY CANNOT BE ANSWERED.

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CHRISTMAS IS COMING!

One of the most welcome gifts you can make to your audiophile friends this Christmas is a subscription to The Audio League Report. Take advantage of our group rates -- 3 or more subscriptions at $3.00 each. Single subscriptions are $4.00 (for 12 issues); two are $3.50 each. Upon request, we will be glad to notify your friends that you are the donor of their subscriptions. Subscriptions can start with either current or back issues.

Audio dealers, distributors, and manufacturers can take advantage of our bulk rates. Please write for details.

A WORD OF EXPLANATION

Magazine advertisements must be placed several months in advance. Our recent ads in "Audio" and "High Fidelity" were written in June, at which time we fully expected to have issues 9, 10 and 11 out by the middle of October. Unfortunately, we were unable to meet this schedule.

We have received numerous inquiries from readers as to why they haven't received issues 10 and 11, since they were advertised in current magazines. There has been no oversight. We are working as hard as we can to get issue #11 out soon.

We do not publish on a regular monthly schedule. We average about six weeks per issue, occasionally taking seven to nine weeks, and sometimes three to four weeks. When issues are sent by third class mail they take from one to four weeks to reach their destination. First Class or Air Mail speeds delivery. For First Class mailing, send $0.75, overseas $1.50. For Air Mail send $1.50, overseas $3. to $6., dependent on country. Please be sure to send your complete code number when writing.

APOLOGIES

1. In our first issue, we published a brief report on the Harman-Kardon "Festival". We were critical of some aspects of this unit and wanted to test additional units, so we promised a more complete report at a future date.

We have been less than fair to Harman-Kardon by not following through promptly with a complete report. It has been called to our attention that our preliminary report has been used by some persons to discredit the Harman-Kardon line. This is unjustified on the basis of the sketchy information we published. The "Festival" we tested was a very early production model, and current models have been changed in several respects. Our statements regarding the "Festival" which appeared in Vol. 1, No. 1, do not apply to current models which we plan to test soon.

2. A somewhat similar situation exists in connection with the Interelectronics "Coronation" amplifier. The model we tested and reported on in Vol. 1, No. 1 is now obsolete. Current models will be obtained and tested in the near future.

ARE YOU A NEW SUBSCRIBER?

In our first issue, we presented a little background on the organization of The Audio League. Many recent subscribers are unaware of this, and are referred to Vol. 1, No. 1 (available at 50¢) for an exposition of our testing philosophy and the manner in which we came into being.

Judging by some of the irate letters we have received relative to long delays in processing subscriptions, failure to acknowledge inquiries, etc., some readers are not aware of some pertinent facts regarding our operation. These are

1) This is a part-time activity by a handful of people. We earn our living as electronic engineers in fields not related to audio. Hi-fi is our hobby.

2) We have been working on Audio League matters for little or no pay for over a year. Our families and homes have frequently been neglected in the interests of testing or writing reports. Sometimes we fall weeks or months behind on vital correspondence connected with our operations. Therefore, it is not surprising that we cannot in general acknowledge or reply to letters from readers. We do enjoy receiving mail from you and assure you it is all carefully read and used to guide future plans. So please write when you feel like it, and don't feel slighted if we don't answer.

* * * *

ADDRESSES AND CODE NUMBERS

Please check your address and code number. If your name is incorrect or the address wrong, please let us know by postcard right away. To avoid errors that come from making sets of labels, we have gone to the expense of address plates which, when once correct, stay that way.

Expiration dates are given in the Code Number. Your subscription expires with this issue if your code number reads 1X10. It expires with the twelfth issue if it reads 1X12, and with Vol. 2, No. 3, if it reads 2X3. If you are supposed to receive your issues first class, your code would include the letter F and if Air Mail the letter A; for example, 2X3F, 2X5A. If we are in error about your expiration date or mail service, please let us know on a postcard. Be sure to include your entire code number when writing.

If you move, please let us know. We may eventually find out the hard way, but you probably won't receive issues in the interim, as 3rd class mail is not forwarded. If you have sent us a renewal or address change, allow one issue to be out with the old plate before writing us again about the change.

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